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WHAT IS CONSTRUCTION?

Four Addresses Delivered at a Dinner Given at the Metropolitan Club, Washington, D. C., on the Evening of May 10, 1921

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Construction

Precursor of National Development

By Noble Foster Hoggson
Hoggson Bros., New York City

IF you and I were cast out today upon a desert island we would immediately find ourselves confronted by the three paramount needs of life—food, clothing and shelter. Granted satisfaction for these fundamentals it is probable that our food would soon be consumed, our clothing worn out, and our shelter would be the only one of the three necessities to remain.

The well-being of any civilized nation depends upon the amount of surplus energy stored in permanent productive wealth. We therefore need continually to recognize and encourage the development of that important part of our national industrial machinery, which is necessary not only for building the shelter, but also for building the plants which produce the food and the clothing as well as the means of transportation by which these necessities are made available. I have in mind "Construction." If I were to ask you to tell me what you think Construction really is, one of you would probably reply, "housing," another "plant construction, commercial building," another "highways and bridges, railroads or canals," perhaps "terminals for rail and ship traffic, or irrigation and reclamation projects" might come to mind, while even the thought of mines

and power stations, city sewerage and water supply would be possible.

Yet all of these are merely divisions or classifications of a single industry, and should always be included in the thought of the whole. An understanding of and a confidence in the indispensable relationship of construction to the sources of our prosperity, and its necessary function in the development of our national wealth is therefore of fundamental importance.

Construction is Civilization

The story of Construction is the story of civilization. No more ancient record of civilized man exists than was recently uncovered in Turkistan on the site of the prehistoric city of Anau in North Kurdan. Here, 12,000 years ago, cities rose and fell and other cities were built upon their ruins.

Five thousand years ago Egyptian rulers were struggling with a problem of unemployed labor not unlike that which England's statesmen are confronting today and which we may be compelled to confront in the near future; they arrived at the solution of their problem by using their idle man-power on government works, such as canals, reservoirs, temples and pyramids.

The grouping of structures in streets of trade, and an increasing attention to the building of homes of wealth and structures for use in worship, and in pleasure, were the beginnings of our modern cities. Walled towns became in due course not only famous centers of trade, "stolen from the desert" by Construction's powerful hand, but the very bulwarks of civilization itself against the invading barbarians.

Rome added road-building to the great

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architectural and construction development which that nation had in common with Greece. Her famous roads knitted together the entire Empire and were the basis of the power of Rome. The still famous aqueducts, viaducts, coliseums, amphitheatres, and temples, remain today the best evidences of the civilization of the world 2,000 years ago.

Through the middle ages the story of Construction runs with ever increasing importance, reaching deeper and deeper into the commercial, religious and social life of the time, responding to every impulse of war or peace, of crusades or world discoveries, of trade organization or religious fervor. The great cathedrals, the guild halls, the castles and fortresses of Europe are the enduring testimony of the development of the men of this period.

The Age of Science

The age of science of whose remarkable growth we are a part, also finds its permanent expression in construction. Is anything more characteristic of the American people than the marvelous sky-line that piles up before one on entering New York harbor, or the cavernous subways that honeycomb the earth beneath it, or the mighty bridges that span the rivers surrounding it? Is there anything more indicative of the spirit of the West than the great belts of steel and concrete that encompass the mountains and the plains, the mighty power dams that hold back the rivers while we harness their unused energy, the great granaries and store houses of the farms, or the wealth producing work shops visible on every hand?

Why is it we place in the corner stone of our great buildings the records of our

day? Why do we carve on their arches and pillars the history of our time? Because they are the most enduring, most permanent depositories we know of for such records.

Did the mighty Cheops return and view these massive works, did Joseph of old visit the great granaries of the West, the Emperors of Rome come back to view the highways that keep the parts of our great empire united, the members of the guilds and merchants of the middle ages see our modern industrial and commercial structures, they would have a clear vision of the march of civilization from their own to the present times.

Construction's Place

These are but fine words, however, and pictures for the imagination, were we not to find in them the meaning for ourselves. First of all they mean that instead of thinking of the building of houses as the individual expression of the fancy of the individual citizen, of the building of highways and railroads as merely the means of an industry we call transportation, of factory building and hydro-electric construction as isolated enterprises embarked in by isolated groups of individuals for private gain, we must think of construction as we do of agriculture, or of mining, or of manufacturing—as one of the great creators of permanent wealth, as one of the foundation stones in our civilization on which our progress is built.

Already indications of this are evident. Construction reports have become equal to crop reports as barometric indicators of the material prosperity of the

country. On their rise and fall depends the well-being of millions of our people, the success of great enterprises, the future welfare of our citizens.

No better example of this exists than the present need for housing. We are just beginning to see what far-reaching effects on the health, the happiness, and the prosperity of our people this single element in construction can have. From a concern which we have been accustomed to think was the business of the individual, it has become the concern of the nation. What is true of housing is true of every other element in the industry. Let our natural development in highways, in railroads, in public work of all kinds be thwarted or disturbed by unwise, uneconomic action or let their progress be hampered by lack of proper action at the proper time, and we have struck a dangerous blow at the very foundation of our civilization.

In the second place these thoughts which I have brought to you, mean, if they mean anything, that every agency that serves this great bulwark of our life should be made to serve it adequately and efficiently. Transportation and finance are the most important of these agencies measured in the needs of the people. Transportation and finance for construction are second only to transportation and finance for food and fuel. As two great economic factors closely and jealously guarded by the people through their governmental agencies, this is perhaps of special interest to you who control the legislation of the country.

The need for adequate information of every kind to keep so vital a part of our life keen and alert is equally important.

Here I refer not only to the need for accurate, unbiased, and well founded news and analyses of conditions—a matter of paramount importance at times such as we are now passing through—but also to the need for adequate, scientific data such as the Government might gather regarding every factor in the industry. And so I might go on to the responsibilities of employer and employee, of architects and engineers, and all agencies within the industry itself. Given the vision of construction in its true relation to the life of all, the part which each must play becomes a service to the nation's permanent welfare.

At every crossing of the ways of life stand the heroic figures of the Builders, inspired and inspiring, sensitive to every impulse, creating, and at the same time utilizing the wealth of nations, rendering into visible form the genius of each age and people. From the ancient days of Anau, and before, down to the present day, Construction has been the expression through which the fundamental impulse underlying the whole of civilization has found form.

The brief sketch of Construction which I have just given you, sounds a challenge to the Industry and to the Nation. It is futile to believe that Construction is less important today than it has been through the past 12,000 years, nor can we hope to solve today's problems if we ignore the striking lessons of the past. Civilization cannot exist without Construction, nor can Construction thrive without public confidence, support, and constructive cooperation which are the basis of civilization itself.

Graft Eras

By F. L. Cranford
Frederick L. Cranford, Inc., Brooklyn, N. Y.

WE invited you here because we want to be acquainted with you and because we want you to know and appreciate the importance of the industry we represent. We have approximately 1,000 members of this organization; we aspire to the position of leadership of our industry; that is why we must know you and you know us.

In the years just preceding the war, the members of this organization built up the public works and utilities of the city, state and nation, industrial plant construction, roads, reclamation and irrigation projects, hydro-electric plants, canals, terminals, warehouse, business and home buildings, and shipping facilities at a cost of a billion and a half dollars a year. Therefore, speaking broadly of the industry and not individually, our function is the construction of the economic facilities or plant of the people of the United States and our activity or our inactivity has a national importance.

Next to agriculture, construction is the largest industry in the United States and upon its development depends the nation's economic future. Are we going to progress in the immediate future, stand still, or retrogress? One of the messages that we have to convey to you is that at the present minute progress in construction is stopped, maintenance of our industrial and economic plant is not being

fully kept up, and such activity as we are engaged in is largely confined to urgent maintenance and repair.

The Key to Development

We feel safe in saying that transportation is the key to development; it has always been the key, not only in America, but in England, Germany, France, and also in ancient Rome, Egypt and Persia. Transportation is originally construction, and transportation in this country has always been the key to development.

The building of the Erie Canal opened the door to the development of the Middle West; the building of the Pacific railroads opened the door of opportunity west of the Mississippi. It is interesting that a very small investment, comparatively, two or three hundred million dollars spread over a period of about sixty years, constructed the facilities which opened the greatest door of opportunity the world has even seen, but every single individual that entered into that door faced another problem of construction, of home building, and the development of our natural resources. Who of us would venture to measure the percentage of development we have now built within this territory?

A curious idea has been cultivated that the railroads should be dealt with as an agency whose existence is antagonistic to the public interest. A few years ago Seth Low being the mayor of New York, a franchise was granted to the Pennsylvania Railroad to build a terminal on Manhattan Island, providing, incidentally, for the construction of tunnels across the North and East Rivers, and that franchise stipulated that none of the facilities

should be used for the transportation of freight, and this restriction denied direct freight delivery to 2,000,000 people then living on Long Island.

I have never heard a public criticism of that prohibition against the use of facilities, needed not only economically, but for our very subsistence, and when a great strike tied up New York Harbor, and again in the winter of 1917-18, when during the critical period of the war we became icebound, we shipped food, munitions, and fuel 140 miles, part of the way over single-tracked railroads, to cross the Hudson River via the Poughkeepsie bridge. The engineers of the Pennsylvania Railroad, to accord with the franchise, had laid out their grades under the river for passenger service only and they did not have a single electric freight locomotive.

Wages

In the period before the war, labor, especially unskilled and semi-skilled labor, did not get a square deal; wages were inadequate properly to support their families. The advance in wages during the war followed usual economic laws, and was to be expected, but the further advance in the post-war period seemed to me unwise and to have a basis somewhat like real estate prices in a boom town. I remember a remark by Mr. Gompers made just after the armistice to the effect that labor would fight for the gains made during the war, and I am inclined to agree with that attitude, but I am sure the post-war advances, which in construction at least equaled the war-time advance, was a mistake and must be undone.

The question of wages is very impor-

tant and its solution essential to our industrial reconstruction. It is too bad that we must wait until unemployment of millions of men with its consequent distress, forces wage reductions. I firmly believe that we should go at this problem with courage and fairness, not misuse the power we now have or that we will soon get. Unemployment for more millions is the alternative.

The Lockwood Investigation

The investigation of the Lockwood Committee in New York has shown graft, price-fixing combinations of many materials and corrupt relations with labor which have destroyed public confidence in the agents of construction. I would like to quote the testimony of two men before the Lockwood Committee.

One gentleman building an office building for a great steamship company stated he agreed to pay $50,000 to a labor leader for the privilege of putting up that building without labor trouble, and that he had received value as agreed —he liked it; the other man stated he had no strikes, he had paid no graft; his work had gone on uninterruptedly throughout the year.

During the last year in New York City, notwithstanding as large a degree of cooperation between builders and union labor as existed in any other community or probably any other industry, labor difficulties were never more frequent—the inference to be drawn from this state of facts is very plain.

Twenty-odd years ago we had a similar situation; in that instance a single man is reported to have brought Sam Parks to New York to control the supply of

labor for his work and to interfere with the supply of labor to his competitors. Such incidents are immoral enough, but the train of trouble which follows is sometimes worse than the original difficulty. The Sam Parks strikes were the prime cause of the organization of the Iron League and the non-union erection of steel on a large percentage of such construction work throughout the United States; the effort to break up this situation developed the McNamara incident, dynamiting steel buildings all over the country, for which a few years ago the courts sent a large number of men to prison. Sam Parks collected a little dirty money incidental only to the operations of an industrial pirate whose machinations now after twenty-years have a continuing effect.

Materials

Construction materials at the peak of the high prices reached an advance of 300 per cent over the prevailing pre-war prices and are still double. The Lockwood Committee has compelled the dissolution of several price-fixing groups—that is, they destroyed the organization through which such price-fixing was initiated, but what the result will be as to the substance remains to be seen. Personally, I believe in cooperation as the way out, but cooperation of the producers, or of the producers and labor, when in either instance the consumer is the victim is an economic crime, and it is used at this time to fleece those in actual need of homes.

The indictment of 110 individuals and firms by the Chicago Federal Grand Jury on April 30 only goes to prove what we

already believed and that was so clearly brought out in the Lockwood Investigation in New York, namely, that price-fixing combinations existed in many construction materials, and it is safe to assume that they operate all over the country. This situation needs drastic treatment.

Housing and Finance

A few months ago this organization sent Mr. Richard Waldo on a trip which covered quite fully the whole United States. He reported upon his return the housing shortage as acute in practically every section of the country, due not only to the actual shortage, but also to the demand for better housing, particularly by the common labor which had received the larger percentage of wage increases. It will interest you, I am sure, to hear that Mr. Waldo visited and talked with bankers everywhere, including the president of every Federal Reserve District. He asked each one of these gentlemen, "what part of their credit facilities they would allocate to construction in the period of reconstruction then approaching." He received the same answer, with one exception from all, that construction was an individual function and credit depended upon the individual standing of the applicant.

The exception, the President of the Federal Reserve Bank of Los Angeles stated, "You have struck our weak spot, we have a nationally organized banking system, but no other industry is similarly organized; we have no information which would permit us to allocate credit to an industry, no matter how great the need."

There has developed during the last few years a quite general acceptance

that a proper home is a necessity which is essential, not only to the individual and his family but to the industry that employs him. There are few things more important to us as a people than to discontinue, wherever possible, the use of the shacks and camps common in many industries such as mines and other remote producers of raw materials. We would all be surprised at the number of men so housed by our railroads. The temporary camp of a construction job or of a lumber camp is often an interesting and fairly satisfactory place and is certainly a necessity, but the permanent housing of large groups in such makeshifts is a very dangerous breeding ground of discontent.

Deferred Construction

We believe that in the present industrial depression the construction industry is an important factor, because it is not only a preliminary step to any new development or enterprise, but because there is a vast delayed program to be performed. Ten years or more ago, E. H. Harriman stated the railroads were in need of an expenditure of a billion dollars a year for five years; that expenditure has not been made and it is probable that the need today is for even a greater amount.

Hydro-electric development has been retarded, due to the withdrawal of all public lands from entry for such use some fourteen years ago.

The development of all public works and utilities was largely stopped upon our entering the war, and financial difficulties have prevented any considerable extension of them since.

Reclamation and irrigation projects have been quiescent since 1914.

With 1,100,000 young men reaching the age of 21, and somewhat less than that number annually being married, it seems safe to estimate that during the last six years there has accumulated a housing shortage of over a million, possibly a million and a quarter homes.

Adding the delayed public works of our cities, and states, roads, terminal facilities, docks, warehouse, factory, home and business building construction, canals, and waterways, it is quite easy to figure a delayed construction program in the United States of fifteen billion dollars.

We are surely going to undertake the greatest construction program that the world has ever seen; we believe that with the initiation of this program will come general prosperity to the people of the United States and it may be that it is an essential preliminary of prosperity. There are several factors which delay the beginning of this work. The great questions of world peace and finance will emerge in their proper time and place. It seems to be our present duty to correct the other factors, so that when the great questions no longer trouble us, we shall be ready to do our share in the work before us.

We feel confident that the fundamental and underlying principle essential to prosperity and to our proper national growth is the development and refinement of our industrial facilities, that in this work transportation in all its various forms is the keystone, but plans for its refinement and the extension of our railroads are obscured by a hostile public opinion. We have a vast project of work

to do which will bring, and may be necessary to general prosperity, with many difficulties yet delaying its start.

I have endeavored to outline the existing conditions in the construction industry and to analyze roughly the extent of the delayed construction program now needed to be performed and the importance of starting that work to the general prosperity of our people.

The Concrete Girdle

By W. A. Rogers
Bates & Rogers Constr. Co., Chicago, Ill.

WITH the advance of civilization a new element on which human life is absolutely dependent has developed. All of the necessities, of which food, clothing and shelter are of first importance, must be transported. In primitive times man carried these things on his own shoulders. As time went on beasts of burden were used for transportation on the narrow trail, then vehicles were built to be drawn by animals, and this necessitated the construction of wider trails or roads.

During the last hundred years, due to the discovery of steam and electricity, has come the development of the steam and electric railroads, operating on a modified form of highway with the wheels traveling on a rail on a solid foundation or roadbed.

The construction of the railroads has made possible the settlement and growth of heretofore inaccessible parts of our country. Before this advent the horse-drawn method of transporting products to and from the markets limited the economical market radius of any particular locality to a very few miles. With the development of the railroads, the economical market radius is very largely increased, in fact is limited only by the ex-

tent of the country and the competition of other sources of supply.

As the railroad lines increased in length and density of traffic, the rolling stock was made heavier and speed of travel increased, requiring the improvement of the roadbed or the railway highway, from the old iron strap rail on wooden stringers and dirt roadbed to the heavy steel rail and rock ballasted track. Today we have a well defined policy and standard of railroad construction for varying conditions and needs.

Advent of the Auto

With the invention and development of the automobile, a new form of transportation or rather an advanced improved form of the old vehicular transportation has come to the front. Just as in the case of the railroads, this has necessitated the improvement and extension of the highway systems of the country. The use of this new transportation is limited by the extent of the hard roads development.

There are in this country today approximately 2,500,000 miles of highways, of which about 50,000 miles might be developed into national or interstate routes or "Main National Routes." There are about 400,000 miles of highways which are State Trunk Lines and which lead into important centers and to and from important market points. I assume that eventually this 450,000 miles of highway will be improved in some form. There are now approximately 300,000 miles improved to a greater or less degree; approximately 45,000 miles are hard-surfaced, 15,000 of which are concrete, and the balance of the 300,000 miles are of gravel or similar form of surfacing.

The construction of concrete roads or similar hard-surfaced roads in any territory has meant the lengthening of the economical hauling radius to any particular point from a team haul radius of about six to eight miles to a truck haul of fifteen to twenty or more miles. The concrete road and truck are doing for the country just what the railroads have done in the development of the United States in years past in developing inaccessible parts of the country.

Concrete has been adopted quite largely by highway engineers as a principal form of material for hard-surfaced roads. The development of concrete in the construction of highways has permitted of their rapid construction and improvement. There is no question but that the construction of concrete and other hard-surfaced roads must go ahead in larger and increasing amounts and we are faced with a stupendous volume of this class of work.

There is a danger that the highway program may be made of such magnitude that it will interfere seriously with railroad development, building and other necessary construction work, which is bound to go ahead as soon as the country gets on a normal basis, by absorbing more than its proper share of labor, materials and railroad transportation, partly due to the fact that highway funds may be secured by the sale of tax free bonds, while other construction, which may be just as necessary, can be financed only by taxable bonds.

It is for the best interests of the country, therefore, that we proceed with this work with an intelligent understanding of the problem before us.

I believe that the United States Department of Highways or the United States Department of Public Works, if our Congress wisely decides to establish such a Department, should have a direct supervision of the entire highway program of the country, if possible, to the extent of regulating in a general way the volume of this class of work which should be done in any one year. Our ultimate aim, of course, should be to construct the completed system of Main National Routes and State Trunk Lines of concrete or other hard-surfaced and feeders to these Trunk Lines to be built of less expensive materials.

5,000 Miles Per Year

I feel sure that in the near future we will be building 5,000 or more miles of concrete roads per annum. In order to get what this means intelligently before us, I am presenting the following figures. For this purpose I have assumed the cost of $40,000 per mile. This would mean for 5,000 miles of highway approximately $200,000,000 expenditure per annum, the employment of about 100,000 men directly on the construction of this 5,000 miles for a period of about eight months, and the indirect employment in the manufacture and preparation of the materials entering into the construction of the highway of approximately an equal number of men, or a total of 200,000 men for a period of about eight months or an expenditure of $150,000,000 directly for labor per annum.

In addition, an investment in plant of sixty to eighty millions per annum is required to construct a program of this size, which investment would have to be renewed at least every four years.

Whether 1,000 or 10,000 miles of hard roads are finished per year, it is impossible to complete a program of this kind without the aid of the responsible contractors. Just as the large railroad systems have been built successfully by contract, so must the highway systems of this country be constructed. This means that the public's money for the construction of highways must pass through the hands of the contractor to the material and machinery men and to labor. It is probable that over a billion dollars will be spent by the people of this country on hard roads within the next ten years.

Development Follows

It seems to be a fact that in the history of this country some form of construction has been the factor that has made possible the subsequent development of the country, for example, the construction of canals permitted the development of Ohio, construction of the railroads in the twenty years after the Civil War permitted the development, agriculturally, of the Western country.

Often this development has seemed to be in advance of its need, but subsequent history has proved that the money has been well spent and that the rapid development of the country has only been made possible by this construction. It seems to me that we are facing an era of highway development comparable to the railroad development in the '70s and '80s. With the history of the past before us, and in view of the magnitude of work to be done, it is well to consider how the interests of the public may be best conserved in this work.

It is evident that this public interest can

only be served by the construction of the best, most permanent roads at the lowest cost consistent with quality, and which will stand up under the loads put upon them, and then limiting the load which can be hauled on them to that for which they were intended.

The construction of concrete highways is a highly technical matter requiring skill obtained only by experience and a competent organization, with a very expensive plant compared to the volume of the work. This can only be secured by the employment of a competent contractor. In order that this end may be attained, it is absolutely necessary that reliable, responsible contractors of experience be attracted to this class of work.

Highway Work Not Desired

In the past, highway work, because of the conditions surrounding it, has not been considered desirable by responsible contractors generally. In fact it has proved to be one of the most hazardous forms of contracting, because of conditions surrounding this work over which the contractor has no control. One of these conditions is that of transportation of materials. This work is absolutely dependent for its economical handling on a uniform supply of materials over the railroads, and in the past this has been difficut if not impossible to obtain. Another condition is that which obtains in the construction of any class of work under any branch of the Government. However, we hope for improvement in transportation conditions and lessening of this uncertainty.

In addition, if the better class of our contractors are to be induced to do this

class of work, there are certain cardinal principles which must be adopted in connection with this work. Three of these principles I designate as Standardization, Stabilization, and Cooperation. Let me explain.

We have in this country forty-eight states and each State has its different type of highway, different specifications as to materials and workmanship, different methods of payment and different types of organization for handling the owner's side of the work.

The contractor who gains his experience and adapts his plant for work in one State, has to remodel and recast his ideas for work in another State. Cost data gained in one State or even sometimes in one County of the State are not applicable without adjustment for another County or in another State.

Materials acceptable in one State may not be in another. The proportions of concrete materials are different. Take the one item of time of mixing the concrete. One State may require that the concrete be mixed a minute, another State a minute and a half to get the same results, when probably mixing half or three-quarters of a minute with a satisfactory machine would give equally good concrete.

Standardization Needed

What is the result? It costs 50 per cent more in labor and fuel to mix concrete a minute and a half than it does a minute, or twice as much as it does to mix three-quarters of a minute. The highway engineers of the Federal Government and the different States in cooperation with contractors of experience

in this class of work should *standardize* plans and specifications and other features of the work, if the money of the people is to be spent economically.

Stabilization

By stabilization I mean that a definite program covering a period of years should be adopted. The investment in plant and organization for highway work is greater than that of almost any other contract work, in proportion to the volume of work. It is hardly reasonable to expect a large outlay for plant to handle this work will be made without reasonable assurance that it will be employed long enough in reasonably profitable work to justify the investment.

Definite programs of work should be adopted by the State or Federal Government covering a fairly definite amount of work to be done each year in the various districts for a period of years.

I can best explain what I mean by reciting the history of the highway programs for the last three years. In 1919 a considerable effort was made by various highway departments to get the responsible contractors of the country to take on highway work. Certain programs of work were outlined, which indicated that this class of work would be available for a number of years, with the result that a good many of the most responsible contractors were attracted to this class of work.

They invested heavily in outfit, took work at what seemed a reasonable price, but more work was let in 1919 than there was material available to build, more than there was transportation to carry the materials from the sources of supply to the work. The result was that the 1919

program was not finished until 1920, and some not even then.

As a consequence the volume of work let in 1920 was very small, but 1921 started with a comparatively clean slate. Contractors were led to believe that a normal program would be adopted for 1921 and the work would go ahead. This has not been the case, but the work has been materially curtailed and the large investments in plant and organization are idle.

What the contractors of the country want is that a certain definite policy be adopted as to the program of work to be done over a period of years, and that the work be awarded either in the Fall or early in the Winter, in order that the contractors may make provision for materials, plant, etc., ready to start immediately when weather becomes suitable for doing concrete work. This is what I mean by Stabilization.

Cooperation

The contractors of the country, and the Associated General Contractors of America are prepared to cooperate with the public, represented by their highway officials in building roads as economically as they can be built. The contractor knows what the work costs. He knows what unnecessary frills cost. He is the only one in a position really to know.

We stand ready to impart this information to the proper people, and the highway problem will never be satisfactorily settled until the highway officials and the contractors acquire the spirit of cooperation, where they will sit down together and arrange the specifications and contracts in such a way that all non-es-

sentials are out, and unnecessary, expensive and drastic features are modified. I am happy to say this is being done in some of the states.

Further, we are prepared, whenever there is any thought on the part of the representatives of the public that we are profiteering, to cooperate with the proper people to determine the truth or falsity of the charge in every way by giving cost data analyzed into its different elements, taken from the records of reputable contractors.

I want to repeat that our organization stands ready to assist in getting roads built at a reasonable price. As a matter of fact, almost without exception, the country has paid considerably less than cost for its concrete highways the last few years.

This cannot continue and there must be a willingness to pay a price for this work, which will result in a reasonable profit, or else the responsible concerns will withdraw from the field and in the end the cost to the public will be increased by the employment of irresponsible firms.

If Standardization, Stabilization and Cooperation are adopted as the slogan of the concrete highway program, we will then build this concrete girdle around this great country of ours in such a way as to get the greatest return with the least expenditure of money, which is the desire of the A. G. C. as a body and of its individual members.

Harnessing Unused Energy

By Arthur S. Bent
Bent Bros., Los Angeles, Calif.

HARNESSING unused energy is a pretty big and indefinite topic, and has doubtless already stirred your imaginations in many directions. My own first thought was how miraculously, overnight, life would be changed, if human energy could be conserved and coordinated, completely. But my subject has a simpler and more feasible aspect than that. The stupendous possibilities of the unused natural energy about us have inspired men of all times from Archimedes, who cried out for standing room while he moved the earth, down to our old friend, Bill Nye, who proposed to condense water over in Oregon and send it to Arizona, there to be diluted for irrigation purposes. Rather impractical schemes, both of them, we'll say.

The uncaught forces of nature are still on every hand, but when we consider how our Morses and Marconis and Curies and Edisons and Wrights and Burbanks are seizing and harnessing them for our use, it seems impossible to overdraw the picture of the world's future.

The story of man's progress in the past has been one of sudden, vivid chapters closely linked up with the harnessing of each new energy from fire to radium.

Consider transportation. Up to 1830

it was practically unchanged from the days of Alexander the Great. My forebears went West by ox team. Then came steam, and suddenly, after having painfully crept only as far West as the Missouri in nearly 200 years, we leaped the rest of the way to the Pacific Coast in decades. H. G. Wells recently said that "Without railways and telegraph it would be easier to administer California from Pekin than from Washington." We know that if our railways should stop, this great Nation would fall to pieces, fall into little states, and become what Europe is today. Well, then, how are we going to keep our railways running?

Great Power Wasted

I was born in the heart of the high Sierras, and so to me unused energy inevitably has one outstanding aspect, water power, and its concomitant, irrigation, and I marvel today as I did twenty years ago, that we waste our precious birthright of fuel energy, while our great Western streams run for the most part unharnessed and destructive. Coal and oil are literally money in the bank, but our streams are unused energy, and in perpetuity.

It seems to me a fatuous pride that boasts of our material achievements of the last fifty years, when as a matter of fact, most that we have accomplished has been at a bankruptcy cost. We have burned down our house to warm our hands. We have been the "Coal Oil Johnny" of the nations scattering in a few hours the accumulated natural wealth of ages.

And now the end of our priceless legacy is in sight. Our forests are

dwindling and we have not replanted them. We can count the coal left in our cellar. We are already wondering what we are going to do for gasoline and for lubricating oil. Germany might have lost the war for want of lubricants. And yet we burn and burn and burn, while fifty millions of horsepower runs continually to waste. Gentlemen, that awful fire burning day and night should be put out. The great army of men who feed it should be disbanded and their energy, harnessed to that of the water and the soil, be turned from destruction to production.

Roughly, it takes 1,000 tons of coal per hour to develop a million kilowatt hours of energy. Disregarding the waste of irrecoverable coal, just consider the army of miners required to produce it. Yet three million kilowatt hours can be developed by the Colorado River alone in only 110 miles of its course. The same energy that the labor of one man produces by water, requires sixteen men to produce by fuel. There's a sixteen to one idea well worth our consideration.

Just think! In the United States this very twenty-four hours forty-three million horsepower was developed with our precious fuel, while fifty-two million hydro-horsepower slipped by us unharnessed into the seas. And of the labor involved in this production, 15/16 was wasted. That waste meant roughly: Eight hours each for 10,000 men and this means interest on a capital of $300,000,000.

And even this takes no account of the fact that a large percentage of the transportation power of our railways is expended to haul coal for their own use.

A good prescription for national pros-

perity, I take it, is a proper balance between raw material, labor and capital. What account of this balance has our power development program taken thus far?

It is pretty widely agreed that the Pacific Coast is to be the center of the greatest drama of history. In that favored and portentous region, lies 50 per cent of the potential hydro-electric power of the country. When we should be conserving and preparing this strategic region for its great destiny, we are wasting its resources and tearing down its defenses.

Power Problem Acute

In my own State of California we have one million horsepower developed and digested, and during the war this was all pooled by intercommunication and is now available at practically every point in the State. This is good. But we have at the same time three million of potential power not touched, and this is bad. The situation with us is acute. We are burning the precious oil which should be saved for our Navy and Marine, and still we are short of power. Our normal growth will absorb this entire four million in fifteen years, and if the steam roads electricize, as they eventually must, it will all be needed in ten years, which is none too long a time to carry out such a vast development program. We can finance it—750 millions in the next eight years, but we must have back of us an enlightened public opinion and helpful Federal and State legislation.

It must be remembered that private profit frequently does not coincide with social gain. The relation between the use-

fulness of a work and its remuneration is often remote. And since we cannot safely consider the care of society's needs as a by-product of individual enterprise, it behooves us as a nation to see to it that the way is made easy and not hard, when private or community capital seeks such essential and beneficent avenues as the development of water power, irrigation and flood control.

The Southwest is turning now to the Colorado River, where many of the best dam sites are within the Grand Canyon Park. It happens that the national parks of the west are mainly on the roof of the country where the great waters have their source and thence tumble idly to the valleys below. The beauty of these parks should not and need not be destroyed, but it is a poor conception of our duty to posterity which fails to utilize these streams for the development of a great and prosperous civilization.

Usefulness Pointed Out

In the case of the Grand Canyon of Arizona, its splendor and availability will be enhanced when we can not only gaze into that stupendous gorge from the two or three accessible points on its rim, but can also ride between its mighty walls for miles over beautiful lakes.

And, of course, when we harness these streams to our impulse wheels, we also make them available for irrigation, storing up their disastrous floods against the dry season when their waters are needed—a by-product which of itself is worth the entire cost, and is not less vital to our development.

In my lifetime I have seen the desert which Southern California once was blos-

som into the garden it is today, by the simple process of harnessing its wasted waters to the soil. When the Colorado River is reservoired it will irrigate three million acres of now arid land, transforming deserts into prosperous communities and adding immeasurably to our national wealth.

Here, then, lies at our hand, particularly in the West, the obvious first answer to the problem of harnessing unused energy. Water power, the cheapest known to man, clean, concentrated, inexhaustible so long as nature functions, the last word in prime movers; and its beneficent corollaries, irrigation and flood control.

The Contractor

These days will doubtless be known to history as the water power age, and will mark, here in America, the highest development of the human race. In this inspiring program, we contractors will play a leading part, for it is our hands that will buckle the harness to this vast energy. So it is fitting that we should take stock of ourselves.

To every thoughtful man must come the ultimate question of where all these marvelous material accomplishments are leading us. Is human welfare really keeping pace with them? Or is it at all true that as we advance in efficiency and power, happiness and spiritual life are receding?

It is largely because we general contractors have been asking ourselves sober questions of this sort, that this young organization exists, and this group of men is here tonight. The General Contractors of America employ steadily a million efficient men and touch intimately every

life in the nation. We realize that this vast energy will be largely evil, if it is dominated by selfish ambition. We have a keen sense of the responsibilities that rest upon us. We believe that to no field of activity comes greater opportunity for human service.

And so we contractors here, and many others not here, are striving to guide the destinies of our great industry along lines of high Americanism, and to harness our energy to intelligent, unselfish, patriotic service. We bespeak for our Association your friendly confidence.

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